

Notice of Allowability

Application No.

10/675,263

Examiner

Fetsum Abraham

Applicant(s)

CAMPBELL ET AL.

Art Unit

2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment after first action and the examiner's amt approved by applicant on 10/28/05.
2. ☒ The allowed claim(s) is/are 1-6,8,10-12 and 14-35.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

Comment

As a matter of discussion, the invention is partly described in the specification as;

Detail Description Paragraph:

[0027] According to the teachings of the present invention, the structure 50 is exposed to plasma etchant of nitrogen trifluoride (NF₃) at a low pressure (i.e., sub-atmospheric), in a range from about 500 mT to about 50,000 mT. The pressure can be varied to affect the results achievable according to the present invention. In one embodiment, a surface of the structure 50 is maintained at a temperature greater than about 100.degree. C., with a preferred temperature of about 140.degree. C. During the etching process the titanium nitride layer 56 is laterally etched through the vias 61, forming voids 62 as illustrated in FIG. 5. The exposure duration determines the amount of material removed and thus the lateral extent of the voids 62. Raising the exposure time etches more of the titanium nitride layer 56 and extends the voids 62. A sufficiently long exposure would cause the etchant to completely remove the titanium nitride layer 56. FIG. 5 illustrates several voids 62 within the structure 50, indicating that the process according to the present invention is consistent and repeatable.

Clearly, what have been partially claimed contradict the invention particularly shown in figure 5.

In the figure, plasma was introduced through the opening 61 and made in contact with layer (56) and the layer etched from its original form shown in figure 4 to the final product in figure 5. The structure in figure 5 can be characterized in two forms;

1) the void (62) formed by etching a portion of layer (56) is in lateral relationship with the opening.

2) a portion of layer (56) **not etched/removed** by the plasma is in lateral relationship with the opening or laterally disposed relative to the opening.

Claims 1 and 52, however, say “.. at least a portion of the material layer removed during the etching step is laterally disposed relative to the opening”, and claim 15 says, “.. at least a portion of removed sacrificial layer material is laterally disposed relative to the opening”. The claims do not represent the invention because once a material layer is partially removed by etching process, the removed portion does not exist anymore. What are left after the etching process are a void and a non-removed portion of the material.

In order to appreciate the allowable subject matter in the invention, the examiner discussed the claims with Mr. John A. DiAngelis Jr, and the gentleman on 10/28/05 gave authorization for this examiner's amendment in a telephone interview.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

The application has been amended as follows:

Claim 1:

The expression “removed’ in claim 1, line 9 is replaced by “not removed”.

The expression “wherein the material layer is selected from among titanium, titanium-nitride, a titanium compound and a titanium alloy.” Is added to be the last paragraph of claim 1.

Claim 15:

The expression “removed” in claim 15, line 10 is replaced by “not removed”.

The expression “wherein the sacrificial material layer is selected from among titanium, titanium-nitride, a titanium compound and a titanium alloy.” Is added to be the last paragraph of claim 15.

Claim 16:

The expression “wherein the sacrificial layer is selected from among titanium, titanium-nitride, a titanium compound and a titanium alloy.” Is added to be the last paragraph of claim 16.

Claim 17:

A full stop is introduced after “the sacrificial layer” in line 3 of claim 17 and the expression after “sacrificial layer” canceled.

Claim 26:

The expression “by plasma containing fluorine-containing gas” is added after “laterally etching” in line 10 of claim 26.

Claims 7,9,13 and 52 are canceled.

The following is an examiner’s statement of reasons for allowance:

Claims 1-6,8,10-12,14-35 have been allowed.

As 1-6,8,10-12,14-21 the claimed method (plasma from fluorine gas) of laterally etching titanium or titanium-nitride or titanium compound or titanium alloy material positioned in a structure kept at a temperature greater than 100 degrees C by first forming an opening in the structure to reach the material by using fluorine gas based plasma etchant material and etching a portion of the material by introducing the etchant on the material to produce a portion of the material in lateral relationship with the opening is not taught or rendered obvious by the prior arts.

As for claims 22-25, the intentional formation of laterally etched sacrificial material, filling the etched portion by a conductive material to be followed by filling said opening by a conductor to complete the claimed contact structure, the process carried by the etchant material in claim 22 and the motivation for selecting the specific method to produce the product is not taught or rendered obvious by the prior arts.

As for claims 26-35, the claimed layers in the claimed order and the etching process performed by the claimed specific method and the motivation of forming the product is neither taught nor rendered obvious by the prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fetsum Abraham whose telephone number is 703-305-3793. The examiner can normally be reached on 8-5.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Flynn Nathan can be reached on 703-308-6601. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Fetsum Abraham

10/28/05